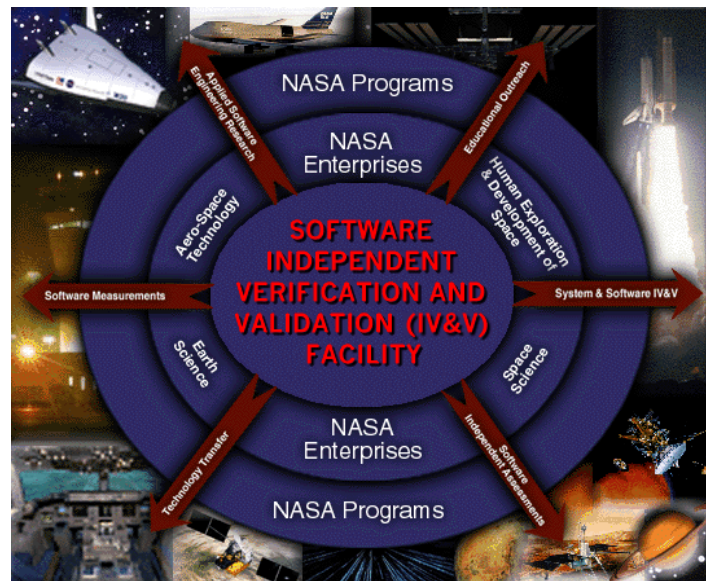


NASA SOFTWARE INDEPENDENT VERIFICATION AND VALIDATION (IV&V) FACILITY



FAIRMONT, WEST VIRGINIA

Mapping a Successful Future

IMPLEMENTATION PLAN 2003-2008

Excerpts from the NASA IV&V Facility Strategic Plan

LETTER FROM THE DIRECTOR

Fellow employees, customers, partners, and our stakeholders:

The NASA IV&V organization implementation plan, *Mapping a Successful Future*, represents the results of our commitment to comprehensive planning as a cornerstone of how we effectively operate and succeed in today's ever-changing world. Our NASA Administrator Sean O'Keefe has stated, "NASA must serve as an effective leader that advances the understanding of our world, from science to service, both today and tomorrow, here and beyond."

As part of our planning process, we offer a new, shared vision for us to strive toward as we go forward. We have defined a more succinct encompassing mission along with delineating common guiding values that we believe are the underpinnings of our purpose and future success. Our plan aligns with the ONE NASA Strategic Plan and supports the Goddard Space Flight Center Implementation Plan.

Based on listening to many different voices from different perspectives of the NASA IV&V organization, a set of overarching goals have been forged that will focus our future actions. As you will read, these goals provide a greater balance of what we traditionally do—research and programs—and where we want to go—toward better and more understood services to our customers, while providing more support to our employees and our community. Our success depends on our daily work being appreciated by our customers and the value placed in our research, educational outreach, and support of our community. The plan clearly delineates our commitments to our customers and to our employees. The customers are at the foundation of our work. Our employees are our most valuable assets.

I look forward to working together with all of you to bring this plan into reality.

Sincerely,



Nelson Keeler
Director, NASA IV&V Facility
Fairmont, West Virginia

"So in the end, NASA is about creating the future . . . and our greatest asset in fulfilling this demanding charter is the excellence of our people." –Sean O'Keefe, NASA Administrator

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*"In broad terms, our mandate is to pioneer the future . . .
to push the envelope . . . to do what has never been done before.
An amazing charter indeed . . . NASA is what Americans . . .
and the people of the world . . . think of when the conversation
turns to the future. "*

—Sean O’Keefe, NASA Administrator

THE IMPLEMENTATION PLANNING PROCESS

Background

The NASA Independent Verification and Validation (IV&V) organization's staff have embarked on a process to establish an increased value-added presence within the NASA community. The effort centers around its main purpose of offering needed software services, including independent verification and validation of the critical software under development, independent assessments of software development practices and products, systems engineering support, and software assurance research.

The NASA IV&V Facility in Fairmont, West Virginia, was established in 1993 as part of an agency-wide strategy to provide the highest achievable levels of safety and cost effectiveness for the mission-critical software of NASA. The facility became part of the

Goddard Space Flight Center (GSFC) in July 2000. Since becoming a part of GSFC, the NASA IV&V organization has completed an initial Business Plan (June 2000), a subsequent Program Plan, and an NPD 8730.4 policy document

Software IV&V is a systems engineering process employing rigorous methodologies for evaluating the correctness and quality of the software product throughout the software life cycle.

—NASA IV&V

(August 2001). These three documents provided the foundation for the initial planning process. The plan reflects the present IV&V organization's view of how best to go forward within the scope of its charge from NASA. This year's update integrates the results of the agency's 2003 IV&V assessments and the work of the Transition Plan undertaken in 2003.

Related to planning, a number of initiatives were undertaken from 2001 to 2003 that involve the facility and the organization. These included organizational development work, enhancing the customer focus process, and performance measurement work.

The NASA IV&V organization continues to grow and become stronger as it contributes to a wide variety of NASA missions and projects. Strategic planning has long been a value embraced and practiced by NASA. The NASA IV&V organization has historically made planning a critical element of its work.

Initial Planning Initiative

In the past few years, the NASA IV&V organization worked toward developing a comprehensive plan to guide its work. During past planning activities, a number of internal issues related to the organization were not fully addressed. In June 2001, Nelson Keeler was named director. In Director Keeler's first year, attention was given to organizational development and customer focus in response to previous planning work that had cited these areas as top priority. These initiatives, along with the start of an internal performance measurements development project, became the foundation for a formal planning initiative that started in late 2001.

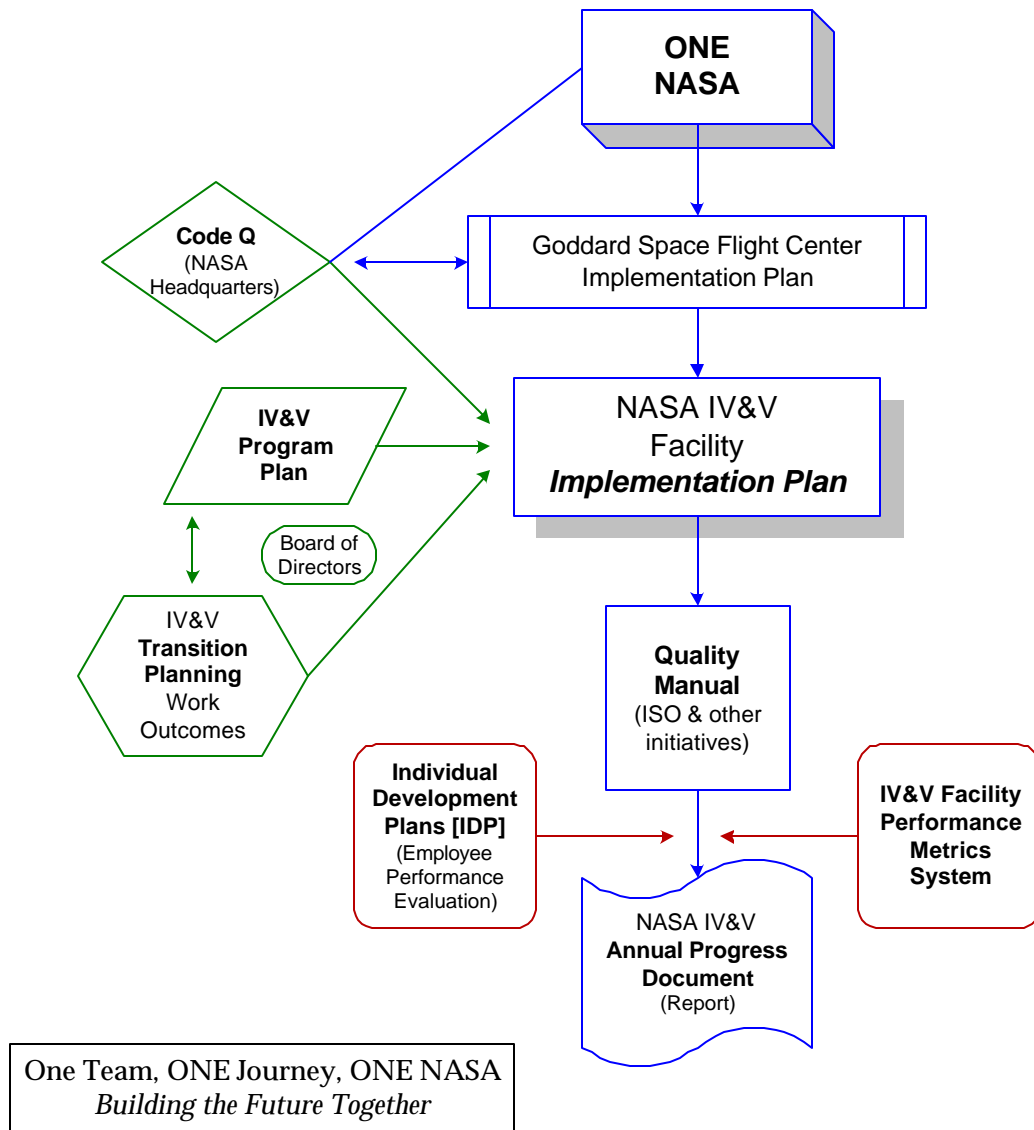
Planning Alignment & Update

The ONE NASA initiative provides the agency's overarching strategic framework for direction, expectations, high level goals, and ultimately strategies that focus all of NASA. The focus challenges both the tasks to be completed, as well as, how the entire agency must work together to reach the success envisioned. From the encompassing ONE NASA initiative to the IV&V reports on progress, there is clearly alignment of planning and organization linkages. The intent is to garner the synergies of integration within the Facility and across entities within NASA. Diagram 1 below reflects how different planning and activities are interrelated.

In December 2003, the IV&V Implementation Plan was reviewed and updated to ensure alignment with other planning.

Diagram 1

Forging an Integrated Approach in Planning, Processes, and Operations
National Aeronautics and Space Administration



VISION, MISSION, AND GUIDING VALUES

NASA IV&V Facility's Vision

A vision statement defines what an organization desires to be. The vision represents the ultimate goal that an organization sets its sights on, even though it may not yet be able to fully meet the goal. The following vision captures the focus that the NASA IV&V organization has for its future.

VISION

To be recognized as the preeminent organization applying and improving independent verification and validation for software and systems.

NASA IV&V Facility's Mission

The mission statement defines the day-to-day purpose of the organization and the steps it takes to reach its vision. The NASA IV&V mission is rooted in the purpose of our facility, its programs and services. The following is the mission for the NASA IV&V organization.

MISSION

To ensure that our customer's mission-critical software and systems are of the highest quality and are reliable and safe by applying software and systems expertise and tools, while researching new approaches, deploying innovative solutions, providing a learning environment, and participating in the vitality of the community.

NASA IV&V Facility further defines its mission as the following:

- Acquiring, developing, and promulgating the very best in independent verification and validation processes, tools, and techniques;
 - Initiating and coordinating software assurance and the IV&V organization research that improves methods and practices, and advances learning;
 - Seeking and embracing collaborative opportunities that garner new ideas, create positive change, and achieve success for all partners;
 - Facilitating the transfer of science and engineering data, methods, and practices to the most appropriate places;
 - Supporting and developing the use of quality standards and performance metrics;
 - Sharing our research and knowledge with education, government, business, and industry;
 - Participating actively in the educational, cultural, and economic vitality of the community in which our employees live and work;
 - Encouraging the development of our personnel and providing them a safe, efficient, and effective environment in which to work.
-

NASA IV&V Facility's Guiding Values

Values—what the organization believes in—are the behaviors or characteristics that are held in high regard in all that is done both within and outside the NASA IV&V organization. These attributes are essential to maintaining and supporting the culture of the organization. The Facility's guiding values clearly map to those of ONE NASA.

These are the shared values that the NASA IV&V organization believes in and holds in high regard. The organization embraces these in our words and deeds as we collectively shape behaviors, pilot actions, deliver services to customers, and establish the organization's culture.

INTEGRITY

Doing what was said would be done; having trust; being honest, fair, and accountable, both personally and organizationally; having steadfast ethical conduct; living by high standards of individual behavior.

TEAMWORK

Working together; supporting each other; collaborating effectively; sharing accomplishments and successes; providing collective wisdom; being responsible; helping others; leveraging synergy; exhibiting open communication.

RESPECT

Noticing individual worth; being open-minded; accepting diversity; seeking first to understand and then to be understood; having credibility; empowering oneself and others; welcoming every idea; listening; being civil.

EXCELLENCE

Producing quality goods and services; doing the right thing; performing second to none; practicing continuous improvement; being distinctive, creative, and committed; leading in best practices; being efficient.

BALANCE

Being well rounded with work, family, and self; balancing professional and personal time; giving to the community; practicing wellness of living; having a balanced involvement that enhances all; being there; coaching others.

INNOVATIVE

Seeking better ways or new methods to do things; being imaginative to enhance processes; staying on the leading edge; being original, agile, adaptive, and responsive to change.

SAFETY

Being safe and ensuring personal safety for employees and the public; providing security for everyone and secured protection of our resources and assets; being good stewards.

NASA IV&V Facility's Customer and Employee Commitments

During the planning process, having a strong customer focus continually surfaced as being important to all that the NASA IV&V organization does. Serving the customer is a central purpose for the NASA IV&V organization and thus, a credo or statement of commitment to all customers was forged to visibly reflect this to all.

COMMITMENT TO OUR CUSTOMERS

Our customers are first and foremost in all we do. For every customer we work with, regardless of the purpose or the length of time, we pledge to do what it takes to truly exceed the customer's expectations. We do this by being responsive, learning and understanding customer requirements, and doing what we promise.

Similarly, recognizing our success in meeting our customer commitment depends on the service provided by our employees. The following statement was developed to reflect our commitment to the IV&V organizational employees.

COMMITMENT TO OUR EMPLOYEES

Our employees are the foundation of our success and our greatest resource. We value each employee and are committed to providing a safe, comfortable, well-equipped workplace while being conducive to creativity, learning, and productivity. Through our guiding principles we will appreciate our diversity, respect each other, and focus on ensuring a balance between professional and personal time.

NASA IV& V OVERARCHING GOALS

The NASA IV&V organization's planning process brought to light many areas on which to focus initiatives in order to sustain what is good, change current practices not valued or working well, and create new opportunities. Furthermore, appropriately tapping these opportunities to help the organization fulfill its mission and reach its vision. The specific results range from small detailed process improvements to broader, more global thinking about what work the IV&V organization should be doing in the future. In the end, the results led to nine major—'overarching'—goals that are to serve as the action-planning focal points. These are presented, without priority, in the box below. Although some goals will require greater attention and more strategies, each is important and needs to be integral to the IV&V organization's planning work. Later sections in this document delineate specific objectives and strategies to help achieve each of these goals. The review completed in January 2004 resulted in an update to the objectives and strategies, but only small wording changes to the overarching goals.

Overarching Goals 2003-2008

- A. Institutionalize IV&V services throughout NASA as a natural 'best practice' and as a wise investment of time and resources.
- B. Become nationally recognized as a preeminent leader in IV&V expertise, tools, and processes.
- C. Develop fully an internationally known and valued software assurance research presence.
- D. Establish a desired organizational culture that engages and rewards employees and cultivates their long-term commitment to the NASA IV&V organization's workforce.
- E. Ensure a focus on customers that is second to none.
- F. Achieve continued quality improvement, compliance, and innovation throughout the NASA IV&V organization to advance effective and efficient operations.
- G. Capitalize on appropriate direct and collaborative opportunities to ensure maximization of existing resources and advance planned future growth.
- H. Be an active partner in our communities' future through educational and community outreach activities, and proactive service.
- I. Ensure a safe, comfortable, and well-equipped workplace that is conducive to high performance and supports individual and team productivity.

OBJECTIVES AND STRATEGIES WITHIN GOALS

Within each major goal, specific objectives are defined. For every objective, one or more strategies are developed that will lead to reaching the objective and ultimately addressing the targeted goal. The majority of strategies address issues that were found in the internal and external assessment process. Some strategies will address more than one goal, and in some cases a strategy could be placed under more than one goal.

For each strategy, specific actions will be developed and implemented as the plan is executed. Actions can be immediate or extend over the period of the planning. NASA IV&V will be flexible in its planning so as to incorporate, as warranted, emerging opportunities or make adjustments to address changing external environmental conditions that relate to it carrying out its mission or fulfilling its vision.

Independent Verification and Validation

Independent

- *Technical—IV&V prioritizes its own efforts.*
- *Managerial—Independent reporting route to Program Management.*
- *Financial—Budget is allocated by program and controlled at high level such that IV&V effectiveness is not compromised.*

Verification (Are we building the product right?)

- *The process of determining whether or not the products of a given phase of the software development cycle fulfill the requirements established during the previous phase.*
- *Is internally complete, consistent, and correct enough to support next phase.*

Validation (Are we building the right product?)

The process of evaluating software throughout its development process to ensure compliance with software requirements. This process ensures

- *Expected behavior when subjected to anticipated events.*
- *No unexpected behavior when subjected to unanticipated events.*
- *System performs to the customer's expectations under all operational conditions*

IV&V Services

Goal A: Institutionalize IV&V services throughout NASA as a natural ‘best practice’ and as a wise investment of time and resources.

Rationale and Background

Although now officially mandated throughout NASA, IV&V is still not openly accepted and used in all areas. Part of this is related to the time needed to transform NASA and the continued development of processes to market and get IV&V contracts in place. This goal will be reached both through proven successes that can be shared and through awareness and education efforts.

IV&V activities encompass all aspects and all phases of system and software engineering and development. The civil servant personnel manage all IV&V activities and, as such, must both ensure continued technology improvement and the ambassadorship of actively educating NASA projects on the value and appropriate levels of IV&V.

Objectives

- a. Ensure IV&V is applied appropriately throughout the Agency.
 - b. Become recognized as valuable throughout the ranks of NASA projects and software managers.
 - c. Gain NASA-wide recognition of IV&V being instrumental to mission success.
 - d. Establish a NASA-wide environment in which Project Managers seek out and welcome IV&V Facility participation.
 - e. Professionally develop all IV&V project managers to be highly effective and efficient with the application and execution of IV&V for all supported missions.
-

Preeminent Leader

Goal B: Become nationally recognized as a preeminent leader in IV&V expertise, tools, and processes.

Rationale and Background

The NASA IV&V organization has a vision to be the preeminent leader in IV&V. As it continues to develop its reputation through successful projects, it must convey this to both customers and those most in a position to offer opinions or influence others interested in IV&V services. Furthermore, the NASA IV&V organization must continue to develop leading-edge tools and processes.

As the NASA IV&V organization continues to gain stature through successful IV&V projects, greater opportunities will surface. Sharing its expertise within the federal government affords both an opportunity for extending the reach of IV&V and for enhancing the software and systems throughout the federal government.

Objectives

- a. Create a culture of continuously improving the discipline of IV&V.
 - b. Develop IV&V tools, processes, and methods that address the changing technology of software development.
 - c. Routinely transfer IV&V technology both internally and to others outside the NASA IV&V organization.
 - d. Ensure IV&V is a respected and valued resource for software and systems conferences, publications, and standards committees.
-

Research Presence

Goal C: Develop fully an internationally known and valued software assurance research presence.

Rationale/Background

The NASA IV&V organization must continue to advance in the area of applied research in software assurance. Developing a strong research program linked to IV&V will be paramount in the overall implementation plan. Increasing research funding and projects will be important.

Research in the areas of software assurance technologies, and systems and software engineering form a backbone for the advancement of software technologies across the agency. A key requirement of this research is to keep the IV&V practices current and, therefore, competitive. The software assurance research is also aimed at developing on behalf of the Safety & Mission Assurance organizations, the tools necessary to perform their tasks.

Objectives

- a. Do precedent-setting research and publish results.
 - b. Objectively show value for IV&V.
 - c. Enhance IV&V practitioners and researchers collaborative work.
-

Quality Workforce

Goal D: Establish a desired organizational culture that engages and rewards employees and cultivates their long-term commitment to the NASA IV&V organization's workforce.

Rationale/Background

A critical need for the NASA IV&V organization is the recruiting, hiring, and retaining of qualified and dedicated staff. Ensuring the needed number and quality of the workforce must be a primary goal for the NASA IV&V organization to achieve its other goals. This area has been studied and some changes put in place in recent years. Also, there needs more attention to formal and effective programs to recognize the work of employees. The Facility's guiding values will be important in ensuring a quality workforce. Continue efforts to instill these as part of the culture will help with the objectives.

Objectives

- a. Cultivate a flexible and efficient workforce to support mission objectives.
 - b. Acquire and sustain a vital workforce (e.g., hiring, recruiting, retention).
 - c. Provide appropriate training and personal growth opportunities for NASA IV&V employees.
 - d. Establish the NASA IV&V organization as a diverse, unified team.
 - e. Foster on-going recognition of employees based on performance and contribution to the Facility.
-

Customer Focus

Goal E: Ensure a focus on customers that is second to none.

Rationale/Background

The NASA IV&V organization has adopted a customer commitment that states its desire to put the customer first and foremost. True customer focus starts with understanding the customers requirements and ensuring the customer is satisfied as to how the requirements are being met. From business processes that support projects to project management, there are a myriad of ways customer focus can exceed expectations or result in failure. Work had begun on a customer focus plan and should be continued. Incorporating customer feedback results into the performance measurement system will be helpful.

Objectives

- a. Refine our institutional and administrative functions to enable efficient, effective, and accurate support to our customers.
 - b. Maintain an active and fully certified ISO standards process as it relates to customer satisfaction.
 - c. Develop a customer 'first and foremost' way within the NASA IV&V culture.
 - d. Ensure open lines of communication with all customers.
-

Quality Operations

Goal F: Achieve continued quality improvement, compliance, and innovation throughout the NASA IV&V organization that advance effective and efficient operations.

Rationale/Background

To support the overall mission of the NASA IV&V organization, attention must be given to operational processes. With limited resources and heavy workloads, ensuring effective and efficient operations is critical. In the assessment outcomes there were a number of references to processes that were frustrating to customers. There are a number of compliance based performance systems that can be helpful to NASA IV&V in assessing the quality of its operations.

Objectives

- a. Create administration business processes that reduce workload on project managers and other staff.
 - b. Instill practices and rewards that foster innovation and creativity in all areas of the NASA IV&V organization.
 - c. Improve the quality and explicitness of our processes to maintain a standard at or above the ISO requirements.
-

Future Growth

Goal G: Capitalize on appropriate direct and collaborative opportunities to ensure maximization of existing resources and advance planned future growth.

Rationale/Background

The NASA IV&V organization continues to explore how best to maximize existing resources, such as its facility and organizational capabilities in Fairmont, WV. The NASA IV&V organization is often asked to partner with other organizations involved directly in a software initiative or some aspect of technology. Located in an area designated as the I-79 Technology Corridor, the NASA IV&V organization has many opportunities to work with other technology-based organizations.

NASA has stated in its new vision and mission development process that activities will be fully integrated across the Agency.

Objectives

- a. Pursue other activities to enhance long-term growth of the NASA IV&V organization.
 - b. Seek effective collaborative opportunities that will advance the NASA IV&V organization's vision and mission.
 - c. Expand customer base (within NASA and other government agencies).
-

Community Partner

Goal H: Be an active partner in our communities' futures through educational and community outreach activities, and proactive service.

Rationale/Background

The assessments clearly pointed to the desire for the NASA IV&V organization to be fully engaged in the communities in which it serves. Although NASA IV&V is already receiving high marks in its educational outreach, there is a general lack of awareness or presence in most other aspects of community involvement.

From economic development focus to community outreach, NASA IV&V should have some presence. NASA IV&V through its own activities and those of its local contractors are contributing to the economic success of surrounding communities as well as in the special relationship it with the West Virginia community. NASA IV&V is committed to service to the community. Education is part of NASA's core mission and must become an integral part of all programs. Furthermore, in the most recent vision and mission statements from NASA clearly reflect the desire that more citizens and students participate in NASA programs.

Objectives

- a. Encourage and enable employees to participate in a diverse set of community activities.
 - b. Increase the awareness of the NASA IV&V organization within the community.
 - c. Provide resources and training opportunities related to science, math, and technology for pre-service and in-service teachers which will have a significant educational impact in the classroom.
-

Quality Workplace

Goal I: Ensure a safe, comfortable, and well-equipped workplace that is conducive to high performance and supports individual and team productivity.

Rationale/Background

The NASA IV&V organization has been noted for its excellent facilities and work environment. A major attraction for future employees and in retaining current ones is how comfortable they are in the workplace. Furthermore, customers who see effective and pleasing workplaces can gain a positive sense of the workforce's ability to adequately provide products and services.

Objectives

- a. Enhance the facility's infrastructure to support all other goals and objectives.
- b. Ensure all aspects related to safety and security are monitored and addressed when improvement or compliance is needed.
- c. Provide for co-location of NASA IV&V staff and contractors within the same locality.

PLAN IMPLEMENTATION

The following are considered important next steps for the NASA IV&V organization's planning process.

Communication Plan

The NASA IV&V organization's leadership will develop a communication process to fully integrate the vision, mission, and values into NASA's work and communication vehicles (e.g., the website, annual progress reports, facility presentations).

As a strategy, information from the implementation plan should be incorporated into the organization's external communication and work activities.

Action Plan

The NASA IV&V organization's leadership will fashion an action table from the implementation plan that delegates and prioritizes the specific actions to be undertaken (i.e., who is responsible and when it should be completed). The detailed action plan will become a document that is monitored and updated as work is completed, as the status of action items change or as new actions become necessary based on emerging requirements or opportunities.

To assist in the implementation of the plan, the Implementation Plan Cabinet has been established. This special team will work with a specific focus on developing the action plan and its implementation.

The World Has Changed

- ❖ *The nation faces extraordinary challenges; the Agency has tremendous opportunities:*
 - ◆ *International terrorism has crossed our borders;*
 - ◆ *Global climate change may threaten our way of life;*
 - ◆ *Shortages of U.S. scientists and engineers threaten our economy;*
 - ◆ *Rapid advances in technology are profoundly affecting business conduct and survival;*
 - ◆ *Life is pervasive; we believe it must exist beyond our planet.*
- ❖ *To continue to serve the nation well, NASA must change.*

-- NASA's Vision April 2002
